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The Rooting Ability of Winter Stored and Freshly Planted Cuttings of *Leuce* Duby (Aspen) Hybrid Clones

by

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The *Populus* L. species from the section *Leuce* Duby (aspens, white poplars) show poor rooting ability of hardwood cutting propagules when compared to those in the *Aigeiros* Duby (cottonwoods) and *Tacamahaca* Spach (balsam poplars) sections. Improved rooting ability would make easy the vegetative propagation of aspens and allow for fast gains in the genetic improvement of these important forest tree species of the Northern Hemisphere.

The poplar breeding of Ontario has the scope of developing hybrid aspens of good rooting ability and vigorous growth (Heimburger, 1968; Zufa, 1969). White poplar (*Populus alba* L.) hybrids demonstrated the best rooting and showed superior growth (Zsuffa, 1973; Anderson and Zsuffa, 1975). However, the rooting was unstable, and sometimes poor rooting was obtained even with clones which had propagated easily in other tests. Thus, the high growth potential of hybrid aspen clones cannot be used in practice without having well established criteria for handling and rooting of the cuttings.

An earlier test (Anonymous, 1968) showed: (i) significant clonal variation in rooting; (ii) freshly collected cuttings planted in spring rooted better than the ones planted in fall. With the trial discussed here the effect of winter storage on rooting was established. Also, the possibility of fall planting was re-examined.

Materials and Methods

In the fall of 1974, in the experimental nursery of the Forest Research Station, Maple, a randomized trial was established in a split-plot design, with 9 clones, 4 treatments, 5 replications and basic plots of 20 cuttings. The planting site was a calcareous clay-loam with a coarser textured, moderately rich "A" horizon and a clay enriched "B" horizon.

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The clones in the trial (Table 1) were chosen for good growth but variable rooting. The following treatments were tried: (A) sprouts harvested, cuttings made and planted in fall; (B) and (C) cuttings made in fall, winter stored in closed polyethylene bags, with moist peat-moss added (B), or without additional moisture holding substratum (C), placed in a freezer at -2 to -4°C, and planted in the spring; and (D) sprouts harvested, cuttings made and planted in the spring.

The cuttings were made from one-year-old well lignified dormant sprouts grown in Maple nursery. They were 20 cm (8 inches) long with clean horizontal cuts. The fall work took place during the first week of November and the spring work during the third week of May. The cuttings were planted manually, to the ground level, in well prepared nursery beds, in 5 x 18 cm (2 x 7 inches) spacing. The rooting bed was covered with dry leaves and lath shade for winter to protect from frost-heaving. The rooting bed was irrigated as needed.

Rooting was assessed at the end of the season on the basis of live trees in each plot. Square-roots of the numbers of unrooted cuttings were submitted to an analysis of variance. The effectiveness of treatments was analysed by comparing the least significant differences. Duncan's new multiple range test (Steel and Torrie, 1960) was calculated for the clonal variation in rooting.

Rooting

A summary of rooting averages according to clones and treatments is presented on Table 1. The results of the analysis of variance (Table 2) show non-significant variation between replications and the reliability of the above averages. The variation in rooting between clones, between treatments and the clones-treatments interactions were highly significant. Duncan's new multiple range test (Table 3) shows the best (C147) and the poorest (GA88, AG186) clones. The treatments are ranked according to their effectiveness in Table 4. The fall planting was by far the poorest. The two ways of winter storage had similar effects on rooting. The spring collection and planting gave the best results. Clones reacted differently to the treatments. Some clones,especially the ones of *P. canescens* (Ait.) Sm. x (*alba x grandidentata*) origin (CAG23 and CAG118), tolerated the fall planting better than the other ones. The variation between clones in their reaction to other treatments seemed to be random (Table 1).

An insecticide treatment applied on the rooted trees at the end of June damaged the leaves and sprouts of many individuals and set back the growth. For this reason a true assessment of growth with regard to treatments and clones could not be made. The plot averages for tree-heights varied from 11 to 58 cm (4.3-22.8 inches), and the height of individual trees in all clones and treatments varied from 5 to 159 cm (2-62.5 inches).

Discussion

The results show very high clonal variation in rooting. Significant variation was obtained even between clones of the same origin (i.e. GA87-GA88, CAG23-CAG118, AK28-AK30, see Tables 1 and 3). This points to the potential of clonal selection. The average rooting of the best clones, excluding the poorly rooted fall planted cuttings, was between 46% and 77%

(AS34 and C147, figures in Table 1). From a practical point of view these results are still unsatisfactory. Further genetic improvements in rooting and improvements in handling of the cuttings are needed if cuttings are to be used as field planting stock, similar to the hybrid cottonwoods.

The rooting technique for hybrid aspen was very simple compared to the ones used for rooting horticultural varieties and coniferous trees. It is likely that significantly better results could be obtained by using covered rooting beds, mist, and treating the cuttings with rooting hormones and fungicides. This last treatment, if effective, could be applied on field planted cuttings. Further research is needed to find better ways for rooting and to establish the technical and economical values of such treatments.

The results obtained with treatments in the trial show the feasibility of winter storage. Both methods ("wet" and "dry") gave similar results, in some cases quite comparable with spring planting of fresh cuttings. Winter storage has many practical advantages over fall or spring harvesting and planting of the cuttings. The fall period between leaf fall of poplar and freezing temperatures, when the soil is cold and no root development can be expected, is usually very short. The unrooted cuttings planted in the fall are exposed to frost heaving and drying before rooting could start in the spring. Also, fall is usually a busy period in the nursery. Similarly, spring is busy and this is a great disadvantage of spring planting period. In addition if spring comes suddenly and the sprouts flush out before cuttings are taken, the rooting can be very poor. Nurseries have more free time in the winter. Sprouts can be easily harvested, even while the ground is frozen, and cuttings can be made comfortably in workshops. The properly stored, dormant cuttings can then be planted at any time in the spring.

Summary

A rooting trial of 9 hybrid aspen clones showed high clonal variation and the feasibility of the winter storage of cuttings. The rooting technique applied was simple. Even the best rooting clones gave unsatisfactory results from a practical point of view. Further research is needed, especially to establish better ways of rooting.

TABLE 1 Clonal variation in rooting under different treatments.
(Averages for 5 replications, 100 cuttings for each clone and treatment.)

Clones	Origin	A Fall collection and planting Rooted %	B Winter storage in peat Rooted %	C Winter storage in dry bags Rooted %	D Spring collection and planting Rooted %	Average for all treatments Rooted %
GA 88	Populus grandidentata x alba, Maple	0	3	8	13	6
AG 186	Populus alba x grandidentata cl. "Hansen", Iowa	0	13	12	15	10
CAG 23	Populus canescens x (alba x grandidentata), Maple	9	14	14	22	15
GA 87	Populus grandidentata x alba, Maple	1	21	29	24	19
AK 28	Populus alba x davidiana f. glandulosa, Maple	8	11	27	36	20
CAG 118	Populus canescens x (alba x grandidentata), Maple	20	31	29	37	29
AK 30	Populus alba x davidiana f. glandulosa, Maple	0	38	35	60	33
AS 34	Populus alba x sieboldii, Maple	2	58	52	55	42
C 147	Populus x canescens cl. "Ingolstadt 9B", W. Germany	3	46	75	77	50
Average for all clones		5	26	31	38	25

TABLE 2

Analysis of variance (on subunit basis[x])

Source of variation	df	SS	MS	F
Replications	4	1.0168	0.2542	1.616 N.S.
Clones	8	27.8797	3.4850	22.155 * *
Error	32	5.0342	0.1573	
Treatments	3	20.6859	6.8953	45.9380 * *
Interaction (clones-treatments)	24	14.6717	0.6113	4.0726 * *
Error	108	16.2100	0.1501	

N.S. non-significant

* * significant at 1%

x Steel and Torrie, 1960, p. 237

TABLE 3

Clonal variation in rooting

(Duncan's Multiple Range Test, significance of differences at 5%)

Clones	GA 88	AG 186	CAG 23	GA 87	AK 28	CAG 118	AK 30	AS 34	C 147
Mean Rooting	6%	10%	15%	19%	20%	29%	33%	42%	50%

TABLE 4

Effectiveness of treatments

(significance of differences at 5%)

	Fall planting A	Winter storage in peat B	Winter storage in dry bags C	Spring collection and planting D
Mean Rooting	5%	26%	31%	38%

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